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OUR IGNORANCE CONCERNING INSECTS*

BY FRANK E. LUTZ,

Curator of Insect Life, American Museum of Natural History, New York, N. Y.

Choosing the title of a talk is often a difficult task.

Being naturally optimistic, I wanted to speak concerning some recent advances in our knowledge of insects. But coming to Canada with a talk bearing such a title would seem like carrying coals to Newcastle, since many of the recent American advances in entomological knowledge have been made on this side of the line, and, in the English-speaking world as a whole, most of the advances have been made under the British flag. Furthermore, being naturally a timid soul, I feared discrimination in the selection of examples.

There is another justification for my deciding to talk about our ignorance. It is that what may turn out to be the really most important advance in our knowledge concerning insects is our coming to an active realization of how great is our ignorance concerning them.

There are several reasons for this ignorance. One is that we have not yet finished what Adam started and Linnaeus reduced to a system. There are so many different kinds of insects, it is so important that we have names for the things with which we work, and so many of our best workers get such a thrill out of the christening ceremonies that thousands of insects have been named by hundreds of good students who had not the slightest knowledge concerning what the creatures they were naming really did or how they lived.

Another reason for our ignorance is our vanity. Having learned something concerning human physiology, for example, we have thought that the physiology of insects must be much the same but, of course, not quite so good. The "not quite so good" has tended to be our sole idea when speculating about the mental processes of insects. We seem to think that we and, to a lesser extent, our vertebrate relatives in the animal kingdom have a monopoly on thinking and that therefore there is nothing left for insects but instinct. I shall return to these two matters presently but in passing I may as well confess that, if we have been right in this, I heartily wish that we had been endowed with a little more instinct to go with such brains as we may have. Instinct must be a wonderful thing if it has made animals such as insects flourish since before Carboniferous time. "If the test of nobility is antiquity of family, then the cockroach is the true aristocrat. Man himself is a creature of but the last twenty minutes or so compared with the cockroach, for, from its crevice by the kitchen sink, it can point its antennae to the coal in the hod and say: 'When that was being made my family was already well established'."

In suggesting another reason for our ignorance concerning insects I am treading on dangerous ground. The danger is not so much that of being con-

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troverted—such a thing is all in the game—but the danger of being misunderstood and, hence, of giving offense. May I quote that passage from Thoreau which I will continue to quote as often as I may until the change which has fortunately been started is completed? It is: "We accuse savages of worshipping only the bad spirit or devil. Though they may distinguish both a good and a bad, they regard only the one which they fear, worship the devil only. We too are savages in this, doing precisely the same thing. We are not chiefly interested in birds and insects, for example, as they are ornamental to the earth and cheering to man, but we spare the lives of the former only on condition that they eat more grubs than they do cherries, and the only account of the insects which the State encourages is of the insects injurious to vegetation."

Economic entomologists should have not only our hearty gratitude but our sincere sympathy. They are put into the front trenches in our so-called War Against Insects and are told to fight; but they are not supplied with the mental ammunition which comes from factories of "pure", as contrasted with "applied" entomology. If we call their work a war, it is a war in which our secret service confines its attention almost entirely to the active enemies and knows practically nothing about our potential enemies, our allies, or the neutrals.

As a matter of fact, while doing more than admitting the reality of the insect menace, while even admitting that we are at present fighting a losing battle against the few kinds of insects that are seriously injuring us, I resent the human proneness to indict a large group for the sins of a few. Dr. Howard in his recent book reproduced a diagram from the Hall of Insect Life at the American Museum showing that certain insects take 20% of our fruit crop. But even so kind a man as Dr. Howard did not reproduce the exhibit which accompanies it pointing out that we would have no fruit were it not for the insects that carry pollen from one blossom to another. No matter how much we may object to young codling moths eating some of the apples which their relatives make possible, we should not forget that we owe to insects the apples eaten by our own young.

Fearing no successful contradiction from the most enthusiastic economic entomologists here tonight I wish to point out that less than half of one percent of all different kinds of insects in an average locality are by any stretch of the imagination really seriously injurious to mankind and this percentage may be better than that for the human population. Possibly ten percent of the insects in such a locality are potentially injurious but, being natives and not enemy aliens, they are held in check by the other native insects which are Man's chief defense.

Furthermore, the majority of the worst of that half of one percent are what I have just called "enemy aliens". Like the Trojans who carried the Greeks in a wooden horse into Troy we have brought these in ships into our country. The entomologists who are here know why I dodge the question of quarantines against foreign insects; but I do not know why so many entomologists are so backward in telling the world that parasitic insects are the best protection we have against the plant-eating kinds. The ornithologists with very little ground in fact have preached the economic value of birds and have suc-

cessfully based their past campaigns on that sordid and shaky platform of birds eating "more grubs than cherries" instead of upon the far safer and more honest platform which they are now adopting that we want birds protected so that some of us may enjoy the beauty of their plumage and song while others of us may shoot those whose killing is considered sport.

Perhaps many entomologists fear that the laymen would not understand them but I have no such fear concerning the laity represented here tonight.

Possibly the most spectacular of the recently introduced insects injuring man's property in my part of the world is the Japanese beetle. Speaking in slang with a bit of a pun on the side, this slide shows a peach of an insect. What is even worse according to the notions of some people thousands of the larvae of these beetles, living underground and eating the roots of grasses, get on the golf course and, by the time they have played one round, the sod can be rolled up like a carpet but it requires big taxes to put down new ones.

Is this beetle so injurious in its native home? Not at all. No more so than our June bugs are here and for the same reason. This reason is not that birds eat them but that our allies among the insects keep them in check. Shall we import birds to feed on this beetle? Please don't. Some misguided bird-lovers once imported the English sparrow, which, incidentally, is neither a sparrow nor particularly English. Our greatest hope for our peaches and golf courses, to say nothing of our other trees and of our lawns, seems to be the introduction so far as possible of the insects which, previously all unknown to mankind, have for centuries been defending eastern Asia against this beetle.

There may be other defenses of which we are still ignorant but, if so, we are much more likely to learn about them from work in pure science done for the pure love of the work and without looking through dollar bills than we are in tax-supported laboratories of applied entomology where quick results are demanded and learning how to poison the landscapes seems to be the easiest way to help the taxpayers.

All of you probably recognize the nest of the tent caterpillar. It is a native American and is usually considered to be a pest, although it eats chiefly wild cherry that we cannot use and a man's chief objection to it seems really to be that we do not like the looks of its nest. However, one point of mentioning it here is that it is a good example of the Balance of Nature. One year it may be very abundant; then in successive years its numbers get less and less until it is practically absent. Just as gradually it comes back to a year of maximum abundance. The beam of Nature's balance has completed its swing. Did birds do it? No. Did parasitic insects do it? That question is an additional reason for mentioning this insect because the tent caterpillar and doubtless many others are apparently kept in check by neither birds nor by parasitic insects but by bacteria; and we are almost completely ignorant concerning the diseases of insects. In this particular case two kinds of bacteria new to science were found by Mr. Brown, a man who was working for the fun of it in a summer camp[1]. One of these bacteria affects the eggs so that no tent caterpillars hatch and the other causes a disease of the ovaries so that few eggs are laid. I am quite aware that economic entomologists report little or no success

1. "Descriptions of New Bacteria Found in Insects"; Brown, F. Martin; 1927; American Museum Novitates No. 251.

in the few attempts that have been made to spread disease among our insect enemies but this may mean nothing more than that previous efforts made with little knowledge have met with little success. At any rate, the study of diseases affecting insects is an almost unexplored field for those who do research "for the fun of it" and that is really a fairly good definition of pure science, the sort of science from which so many practical applications have come.

Why have the pure-science students of biology so largely neglected insects? Certainly among the thousand or more kinds of insects on the campus of any college that has a real campus there are insects wonderfully adapted to laboratory experiments. About twenty-five years ago I gave Professor T. H. Morgan a strain of ordinary vinegar flies that had shown white eyes. Working with that strain he and his students have built up a magnificent demonstration of the role which chromosomes play in heredity; and now with descendants of that same strain other students are demonstrating the effect of X-rays in the production of mutations.

This little story does me no credit for I confess that, had I not, like so many entomologists, been ignorant concerning the insects with which I was working, I certainly would not have parted with them before I had written at least one paper about them myself. However, the story is told here as an illustration of the not yet fully realized value of insects as research material in biological pure science. These flies have taught us more about the laws of heredity than a century of guinea pigs could have done.

Perhaps John Burroughs gave one of the main reasons for the neglect of insects by general biologists. I had asked him why he did not include them in his nature writings and he replied: "I have often been tempted to do so but the field is so vast and so full of pitfalls that I am afraid to enter it."

Most of the general biologists know that the entomological field is vast but I am certain that very few of them realize how vast it actually is. All living things that are neither plants nor bacteria are animals; and zoology is the study of animals. Some years ago I said a very impertinent but an absolutely truthful thing when one of its principal trustees referred to the New York Zoological Gardens. I told him that I did not know that New York had a zoological garden. "What! Have you never been to our Gardens in the Bronx?" "Oh yes,' I said, "but they are not zoological gardens. They are merely gardens of vertebrate zoology. You have no insectary; and three quarters of the kinds of animals are insects." He was so flabbergasted at either the truth I told him or at my impudence in saying it that he could think of no reply except a request that I give him a memorandum on the subject so that he might do something about it. I did but he hasn't.

This diagram speaks for itself but you can not well carry it around with you so that you may have it handy to show to your friends. However, Nature has built a copy of it into each of us. Stretch your arms and fingers out horizontally at your sides. Now, if you take the distance between the tips of the fingers of your outstretched arms as representing the number of different kinds of animals living today, the last joint of the middle finger of your right hand will represent the number of different kinds of mammals. The middle joint of that finger will represent the number of different kinds of reptiles and their

kin. The first joint of the same finger will represent the number of different kinds of birds; and the distance from the knuckles to the wrist will represent the fishes. In other words, you can hold our so-called zoological gardens and their aquarium annexes in one hand.

The length of one forearm from the wrist to the elbow would, on the same scale, represent the number of different kinds of spiders, worms, known protozoa and all other invertebrates that are not insects. And you have left the distance from that elbow to the shoulder, across your chest, and out to the tips of the outstretched fingers of the other arm to represent the number of different, already-described, insects now living on this earth. What right has any man to call himself a zoologist when he doesn't know a bug from a beetle? But a more important question for us is as to why we let ourselves and our subject suffer from the absurd and illogical modesty which leads us to call ourselves entomologists instead of zoologists.

There is more to these questions than pride and a pardonable desire for recognition. There is the fact which is fundamental to a proper understanding not only of zoology but of biology in general. It is the fact that Maeterlink saw when he wrote: "Something in the insects seems to be alien to the habits, morals and psychology of our globe, as if it had come from some other planet, more monstrous, more energetic, more insensate, more atrocious, more infernal than our own. With whatever authority, with whatever fecundity, unequaled here below, the insect seizes on life, we fail to accustom ourselves to the thought that it is an expression of that Nature whose privileged offspring we claim to be. ..... No doubt, in this astonishment and failure to comprehend, we are beset with an indefinable, profound and instinctive uneasiness, inspired by beings so incomparably better armed and endowed than ourselves, concentrations of energy and activity in which we divine our most mysterious foes, the rivals of our last hours, and perhaps our successors."

(to be continued)

UNDESCRIBED NORTH AMERICAN SPECIES OF PSELAPHIDAE (COLEOPTERA), INCLUDING A SYNOPSIS OF THE GENUS RHEXIDIUS CASEY.

BY FRANK C. FLETCHER,
Minneapolis, Minnesota, U.S.A.

The following species, with one exception, are a part of those loaned me by various institutions during the course of my work on a revision of the North American species of the family.

The location of the type is, in every case, indicated immediately after the description.

Rhexidius perscitus n. sp.

♂. Elongate, depressed, narrowed anteriorly; piceous, elytra red, legs yellow; minutely punctulate, shining; pubescence pale, short, recumbent. Head transverse, somewhat more than one-fourth broader than long (measured to front margin of epistoma, and not including the eyes), slightly narrower than prothorax; tempora rounded, distinct; surface slightly convex, with a deep curved sulcus connecting the two large pubescent foveae of the vertex; this sulcus bearing, anterior to the large foveae and behind the antennal tubercles,

a pair of very small punctiform foveae closer to one another than are the foveae of the vertex; anterior margin of sulcus prominent; disk with a few granules, shining; occiput incised. Antennae reaching almost to base of prothorax, rather stout; segment 1 elongate, not modified, 2 a little larger, globular, 3 narrower, transverse, 4 still broader, more transverse, 5-6 distinctly broader than those on either side, the latter broader than 5, one-half broader than long and slightly longer, both very transverse and slightly excentric, 7-8 slightly narrower than 6, 7 a little longer than 8, both very transverse, 9 perceptibly wider, very transverse, one-half broader than long, 10 longer but still transverse, 11 slightly longer than the two preceding together, ovoid, club not distinct. Prothorax exactly equal in length and breadth, widest three-fifths from base, then obliquely narrowed to base, apex narrowed to a neck; disk convex, with a deep median sulcus reaching apical one-fifth, crossed near base by a transverse sulcus connecting a pair of deep lateral pubescent foveae; feebly punctulate, shining. Elytra slightly transverse, widest near apex, regularly rounded to base; humeral callus distinct; disk convex, shining; sutural striae deep and entire; each elytron with three dorsal striae varying in length as follows; the first (next to the sutural stria), distinct towards base, vanishing about apical one-third, second finer of about same length and the third, sharp on the inside of the humeral callus, but not extending beyond it; base of each elytron quadrifoveate, the outer two foveae close together. Abdomen about equal in length to the elytra, the dorsal segments gradually decreasing in length; first dorsal without carinae, but provided with a transverse depression at base, the width of which includes between one-third and one-fourth of the entire width of the segment; undersurface unmodified, the sixth segment somewhat impressed towards base, the last forming a convex transverse operculum. Metasternum convex. Legs unmodified. Length; 1 2-5 mm.; breadth 3-5 mm.

♀. Similar to the ♂ but broader behind; antennae similar, 3 globular, the others less transverse, regularly increasing in width, the last more acute; humeral callus less pronounced; first dorsal stria of elytra shorter.

Holotype; ♂. Black Mt., N. C. X. 5/01. (American Museum of Natural History).

Allotype; ♀. Same place. IX. 23/01. (A.M.N.H.).

Paratypes: 2 ♂ ♂. Same place. X. 5/01 and IX. 19/01; 3 ♀ ♀. Same place. IX. 26/01 and VI/24. (A.M.N.H. and author).

The four ♀ ♀ are paler in color than the ♂ ♂; the darkest being a deep red-brown, the others forming a gradation to a honey yellow.

This species has no close relative except *trogasteroides* Brend. which also possesses three dorsal striae in addition to a sutural, but differs strikingly in having antennal segments five and six very much produced internally.

Rhexidius intermedius described by Brendel in an unsatisfactory manner, without a citation of locality, is entirely unknown to me. Brendel's type is apparently no longer in existence, a thorough search on my part failed to locate it in his collection. I believed at first that the above described species might be Brendel's *intermedius* and considered establishing it as neotype. *Intermedius* is said to have in the ♀ a twice-interrupted median prothoracic sulcus triangularly dilated at the middle, and the depression of the base of the abdomen divided by a short carina; the ♂ is said to have the median sulcus uninterrupted,

but abbreviated in anterior third. If Brendel's description can be trusted at all, *perscitus* though related, certainly is not identical, as it does not possess those features. In view of these differences and lack of a locality citation for *intermedius,* it seems to me best not to select a neotype, but to describe my species as new.

The following synopsis will serve to distinguish the species of the genus *Rhexidius* Casey.

1. Disk of each elytron with one sutural and three distinct dorsal striae; head not modified in ♂ 2
   Disk of each elytron with one sutural and one ill-defined dorsal stria at base: head modified in ♂. (Eastern North American).....*canaliculatus* Lec.
2. Antennal segments not strikingly modified in either sex.....3
   Antennal segments 5-6 strikingly produced internally in the ♂. (Penn.) .....*trogasteroides* Brend.
3. Surface of body granulate; fourth dorsal of ♂ impressed.....4
   Surface smooth; fourth dorsal simple in ♂. (N. C.).....*perscitus* n. sp.
4. Humeri obsolete; pubescence long and straight. (Cal.).....*granulosus* Csy.
   Humeri distinct; pubescence fine, recurved. (Cal.) .....*asperulus* Csy.

Reichenbachia snowi n. sp.

♂. Strongly convex, oval; rufo-testaceous, hardly evidently punctate; pubescence fine, pale, very short and recurved; strongly shining. Head quadrate, narrowed anteriorly; tempora broadly rounded, not prominent; head narrower than prothorax, the disk feebly convex, with two large pubescent foveae on the middle ocular line, about the same distance from one another as from the eyes; anterior fovea identical with the others, situated between the antennal tubercles on the sloping front. Antennae long and slender; segment 1 normal, unmodified, 2 elongate, subcylindrical, 3 obconic, slightly shorter than 2, 4 subquadrate or moniliform, just perceptibly wider than 3, 5 cylindrical about one-half longer than broad, this and the remaining perceptibly gradually incrassate, 6 of same form as 5, shorter, 7, still shorter, cylindric, 8 and 9 subquadrate, 9 more abruptly broader, 10 somewhat longer than broad, a little narrower at base, 11 elongate, about as long as the three preceding together, the entire surface of the last four segments and the inner surface of the others covered with large asperities. Prothorax convex, slightly transverse, widest in front of middle, oblique to base and feebly sinuate to apex; disk with the usual small basal fovea and two large pubescent lateral ones. Elytra slightly transverse, widest at apex and feebly rounded to base; humeri rounded, not prominent; disk very convex, with a strong sutural stria and an arcuate dorsal stria which reaches apical fourth; base of each elytron with four small foveae. Abdomen a little wider than elytra; first dorsal much longer than the others, these decreasing in length; apex descending; first dorsal with a pair of slightly diverging carinae, including between them one-third of the total width of the segment, and extending one-half the length of the segment; undersurface flattened, the terminal segment large, slightly concave. Metasternum somewhat concave, laterally prominent. Legs slender, normal; the middle coxae armed internally with a long, curving spine or tooth; middle tibia with a long, oblique spine at apex. Length 1 3/5 mm; breadth 3/5 mm.

Holotype: ♂. Oak Creek Canon, Arizona. 6,000 ft. July. F. H. Snow. (University of Kansas).

Somewhat closely related to *informis* Casey; it differs however, in possessing a still more feebly modified antenna, the segments 5-6 distinctly longer than broad and cylindrical. This is one of the few western Reichenbachias not possessing strongly modified antenna.

Reichenbachia ignobilis n. sp.

♂. Form oval, convex; uniform rufo-testaceous; not visibly punctate, shining; pubescence very short, recurved. Head distinctly transverse (measured from antennal tubercles to base and excluding eyes) or slightly longer than broad (measured from anterior margin of epistoma to base of head), distinctly narrower than prothorax; surface convex, tempora rounded, rather distinct; the middle line between the eyes bearing two large pubescent foveae, nearer the eyes than to one another; between the antennae the front is thickened and somewhat prolonged forward in the form of a blunt, slightly transverse tubercle; beneath which at the margin of the front are two tufts of incurving hairs; epistoma plane and exceedingly depressed; between the epistoma and the front and beneath the latter, is a deep, transverse cavity, the back wall of which bears a transverse lamella which extends forward on to the surface of the epistoma in the form of a very fine carina, almost reaching the apex. Antennae slender; segment 1 normal; 2 elongate, cylindrical, as long as the first and twice as long as the third, bearing at the extreme apex a short, blunt tooth having a few setae; 3-9 very gradually increasing in width; 3 itself, obconic, much narrower than 2, 4 cylindrical, about equal in length to 3. 5 cylindrical, about as long as the two preceding together, 6 of same form and about equal in length, 7-8 slightly longer than broad, somewhat more prominent internally, 9 more distinctly broader, just perceptibly longer than broad, 10 distinctly broader of same form as 9, 11 rather broadly ovate, slightly longer than the two preceding together, club not at all distinct. Prothorax equal in length and breadth, widest in front of middle, obliquely narrowed to base, and rounded to apex; disk convex, with the usual small, median, basal fovea and the two large pubescent lateral ones. Elytra convex, slightly transverse; humeri rounded, not very prominent; sutural stria distinct; a fine incurving dorsal stria reaching about to apical seventh; base of each elytron with three small foveae. Abdomen as wide as the elytra; first dorsal longer than the others, bearing at base, two short divergent carinae, including between them one-third of the total width of the segment and extending only about one-fifth of the length of the segment; undersurface not perceptibly flattened, the last segment large but not modified in any way. Metasternum slightly depressed. Legs slender, not modified; the middle coxae with an acute tooth at apex. Length 1 3/5 mm.; breadth 4/5 mm.

Holotype; ♂. San Bernardino Ranch. Cochise Co., Arizona. 3750 ft. August. F. H. Snow. (University of Kansas).

Ignobilis shows no close relationship with any described North American *Reichenbachia*, and can only be compared with *tumida* Lec. It differs in several important characters among which, the striking sculpture of the head, entirely different from *tumida* and the spine at the apex of the first antennal segment will serve to at once identify it. *Ignobilis* is a member of Raffray's Group LVI.

Reichenbachia gentilis n. sp.

♂. Strongly convex, robust; body dark brown, elytra red; hardly perceptibly punctulate, shining; pubescence scattered, short, recurved. Head slightly longer than broad (measured from base to anterior margin of epistoma, excluding eyes), distinctly narrower than prothorax; tempora rounded, distinct; disk convex posteriorly; front evenly sloping; vertex with two very large, deep, pubescent foveae on the middle line of the eyes, closer to the eyes than to one another; anterior fovea entirely wanting; the front between the distinct antennal tubercles and the epistoma entirely rugose and sparsely clothed with long hair. Antennae short and stout; segment 1 rather large but unmodified, 2 subglobular, slightly compressed dorso-ventrally, 3 much smaller, globular, 4 of same size, somewhat transverse; 5 about as long as 4, decidedly transverse, about a third broader than 4, 6 of about same length as 5 much more transverse and much wider, twice as broad as 4, very much produced internally, tooth-like, 7 similar in every way to 6 except that it is just perceptibly wider, 10 transverse, still broader, 11 oval, obliquely pointed, the last four segments gradually broader. Prothorax distinctly transverse, sides oblique to base, rounded to apex; disk very convex, with the usual foveae. Elytra very transverse, widest near apex, humeri distinct; dorsal stria incurved, sharp, reaching apical fifth; base of each elytron with three foveae. Abdomen not broader than elytra; dorsal segments decreasing in length, the first, bearing at base a pair of very fine parallel carinae, not reaching beyond basal fourth and including between them one-third of the total width of the segment; undersurface slightly flattened; base of the last ventral somewhat impressed. Metasternum concave. Legs slender, posterior femora distinctly but not abruptly broader in apical half, the under surface being flattened about the whole length of the femur; posterior tibiae less thickened at tip than in *falli*, but much more arcuate. Length 1 2/5 mm.; breadth 4/5 mm.

Holotype: ♂. "Cal". (Horn Collection—Philadelphia Academy of Natural Sciences).

Gentilis is closely related to *falli* Casey and *turgidicornis* Casey. It resembles *falli* in that the posterior femora have nearly the same form, but the antennal segments 6-7 are much different in form. From *turgidicornis* it may at once be distinguished by the 5th antennal segment being shorter and more transverse, 6 very short, transverse, and exceedingly produced internally, much shorter than 5, 7 just perceptibly wider, but otherwise the same; these two segments are strikingly shorter, thinner and more produced than the same segments in *turgidicornis*. The simple posterior femora of *turgidicornis* will also serve to distinguish the two.

Arthmius (Arthmius) morsus n. sp.

♂. Elongate-oval, narrowed anteriorly; rufo-testaceous; not perceptibly punctate, the elytra somewhat roughened, shining; pubescence pale and scattered. Head subquadrate, in general flat above, somewhat convex behind; distinctly narrower than prothorax (excluding eyes) front evenly rounded; tempora rounded, not prominent; a pair of small, but deep foveae behind the middle line of the eyes, and much closer to them than to one another; antennal tubercles fairly prominent and bearing several coarse punctures and a slight depression im-

mediately behind them; vertex with a shallow depression which may be accidental; anterior margin of epistoma feebly emarginate. Antennae rather short and stout; segment 2 quadrate, perceptibly wider than the immediate following, 3 slightly narrower than the next, obconic, 4 a little narrower than 5, subglobular, 5 longer than wide, cylindrical, slightly broader than 4 or 6, the latter being of same shape, 7 similar to 6, 8 quadrate, somewhat moniliform, 9 abruptly larger, obconic, very slightly excentric, 10 about as wide as long, of same width as 9, 11 ovate, acuminate, as long as the two preceding together. Prothorax quadrate, as wide as long, widest anterior to the middle and regularly narrowed to base; disk convex, very shining, a very fine transverse basal sulcus connects two deep lateral foveae. Elytra convex, transverse; humeri not evident; a strong sutural stria and a vague basal depression representing the dorsal; three basal foveae present. Abdomen considerably longer than elytra; first dorsal very long, exceeding the remaining segments together; base with a pair of parallel carinae, one fourth the length of the segment, and including between them four-ninths of the total width of the first segment; undersurface convex; first segment longer than any except the penultimate, bearing a sharp median carina reaching almost to apex; penultimate segment distinctly concave anteriorly, becoming suddenly much more concave in posterior one-third, the anterior edge limited by a sharp, short, transverse carina; the posterior edge of the segment is deeply emarginate to hold the more or less transverse terminal, which, like the arms of the emargination is covered with coarse punctures. Metasternum longitudinally sulcate. Legs rather long; anterior tibiae suddenly greatly swollen at middle and covered at this point, on its anterior face with numerous rugosities; within at apex, the tibia is provided with a patch of long pale hair; middle tibiae rather stout. Length; 1 4/5 mm.; breadth 4/5 mm.

Holotype; ♂. Oak Creek Canon, Arizona. 6,000 ft. July. F. H. Snow. (University of Kansas).

This species is a member of Raffray's Group V, characterized by the simple antennae and modified legs. It is related to *simplicicornis* Sharp and *latipes* Raffray, both described from Central America. *Morsus* like these, has the anterior tibiae modified, but in this case the tibia has simply a large convex swelling at its middle, instead of an angulate swelling or an elongate dilatation. The species of this genus heretofore known from North America all belong in Raffray's Group III.

Hamotus (Hamotoides) opimus n. sp.

♀. Elongate, narrowed anteriorly; uniform rufous in color; finely punctulate, elytra more coarsely and aciculately so, shining; pubescence tawny, dense, rather short, recurved. Head slightly longer than broad, (excluding eyes); abruptly constricted in front of the eyes, forming a broad antennal tubercle; tempora rounded not prominent; a pair of large foveae on the median line of the eyes, closer to them than to one another; a third between the lateral antennal tubercles which are prominent. Antennae rather stout; segment 1 elongate, subcylindrical, longer than any of the others except the last, 2 cylindrical, slightly longer than broad, broader than the immediate succeeding, 3 subcylindrical, or somewhat obconic, longer than broad, 4-5 of same shape, distinctly transverse, the latter just perceptibly shorter, 6-8 of same form, more

transverse, 9 abruptly larger, quadrate, somewhat narrower at base, 10 of same form, longer, somewhat transverse, 11 equal in length to the two preceding together, broadly oval, very obtusely pointed; the last three segments forming a very distinct club. Palpi with the last segment broadly oval, a blunt appendage at apex, the inner side with a deep sulcus, as usual. Prothorax about one-sixth broader than long, distinctly wider than the head; disk very convex, bearing at base a transverse sulcus, which has a very small median fovea almost entirely obscured by a tuft of hairs; this sulcus joining on either side a pair of large foveae, situated on the lateral margin; as a result of this, the sides of the prothorax, when seen from above, appear emarginate behind the middle, anteriorly nodose; disk rather densely pubescent, and punctate or aciculate. Elytra distinctly transverse, widest at the middle; humeri rounded, distinct; disk very convex, with deep entire sutural striae, and a short vague impression at the base representing the discal stria. Abdomen broader than elytra, first two dorsal segments subequal in length; undersurface convex, unmodified. Metasternum broadly impressed. Legs entirely unmodified. Length; 2 mm. breadth 5/6 mm.

Holotype; ♀. Palm Beach, Florida. April 13, 1923. Frank C. Fletcher, Collector. (Collection of author).

Paratype; 1 ♀. Same data. (Collection of author).

These two pselaphids were taken sweeping herbage around the edges of a marsh, situated beyond the railroad tracks west of West Palm Beach.

This species can be compared only with *nodicollis* Raffray described from Mexico. Both have the lateral foveae placed far down on the sides of the prothorax, rendering the margin incised and nodose when viewed from above. However the relationship between the two is not very close as *nodicollis* has the median thoracic fovea very large and distinct, while in the present species it is hardly visible.

This genus has not in the past been recorded in our lists of North American *Coleoptera*. Within it should also be placed the *Tyrus elongatus* Brendel (Bull. Lab. Nat. Hist. State Univ. of Iowa. 1890. Vol. 1. Page 239.) which in Leng's Catalogue, reposes as a synonym of *Cerocerus batrisoides*. *Elongatus* is at once distinguished from *opimus* by the usual position of the lateral thoracic foveae; they do not incise the margins, and by the elongate terminal segment of the maxillary palpus.

The genus *Hamotus* is a large one and is widely distributed throughout the Neotropical region.

A SYNOPTIC REVISION OF THE GENERIC CLASSIFICATION OF THE CHELONETHID FAMILY CHELIFERIDAE SIMON. (ARACHNIDA)

BY JOSEPH CONRAD CHAMBERLIN,
Twin Falls, Idaho

(continued from page 21)

Ellingsenius gen. nov.

Orthotype. Chelifer sculpturatus Lewis.

Diagnosis and remarks. Characterized and discriminated from its relatives in the preceding keys. Three species (two South African and one In-

dian) may be referred to the genus. They may be separated by means of the following keys.

1. Femur and tibia of palps deeply sculptured, being thickly beset dorsally and laterally with very large setose tubercles 2
   Femur and tibia of palps normally granulate, not deeply sculptured; (tarsal spines absent or vestigial) .....*fulleri* (Hewitt & Godfrey)
2. Anterior margin of femur exhibiting in profile about 7-9 of the large seta bearing tubercles; posterior margin of tibia with a similar number; tarsal spines absent or vestigial .....*sculpturatus* (Lewis)
   Anterior margin of femur exhibiting in profile about 12-15 of the prominent seta-bearing tubercles; posterior margin of tibia without larger tubercles; tarsal spines prominent .....*indicus* sp. nov.

The following supplementary key is based upon a different set of characters and refers especially to the male.

1. Coxal sacs present; ramshorn organs present; tarsal spines absent or vestigial; tergal crests not as in *indicus* 2
   Coxal sacs absent; ramshorn organs apparently absent; tarsal spines prominent; tergal crests occur on the 1-9th tergites inclusive.....*indicus* sp. nov.
2. Coxal sacs large and well-developed; tergal crests occur on the first ten tergites; femur and tibia of palps deeply sculptured....*sculpturatus* (Lewis)
   Coxal sacs weakly developed; tergal crests occur on tergites 1-8; palps normally granulate .....*fulleri* (Hewitt & Godfrey)

Ellingsenius fulleri (Hewitt & Godfrey)

1929. *Chelifer fulleri* Hewitt & Godfrey. p. 331; tf., 1a, 7 & pl. 22, f. 11.

Remarks. In spite of the lack of the larger tubercles so characteristic of *sculpturatus* and *indicus* there is no doubt that *fulleri* is congeneric with these two species. This South African form, like its congenor *sculpturatus,* is definitely associated with bees.

Ellingsenius sculpturatus (Lewis)

1903. *Chelifer sculpturatus* Lewis. pp. 497-498; pl. 25.
1905. *Chelifer sculpturatus* Lewis. With, p. 117; figs. (Redescription.)
1912. *Chelifer sculpturatus* Lewis. Ellingsen, p. 99. (Distributional data.)
1929. *Chelifer sculpturatus* Lewis. Anon. p. 293. Commensalism.)
1929. *Chelifer sculpturatus* Lewis. Hewitt & Godfrey, p. 327; figs. (Redescription, etc.)

Material examined. 2 ♂, 1 ♀, (JC-554.01001-3) from Mafeking, South Africa. Obtained by exchange from Dr. John Hewitt. 2 ♀, (JC-728.01001-2) labeled, "Claremont, California" and included in a general collection of false scorpions received from Dr. C. R. Crosby of Cornell University.

Remarks. The California collection noted above is certainly most surprising. Personally I cannot help believing that the specimens in all likelihood are really African and that the label and specimens were fortuitously associated. Otherwise we must assume that *sculpturatus* has been introduced into California, which supposition is of course not at all impossible. More data are eagerly anticipated.

Ellingsenius indicus sp. nov.

Holotype, ♂, (JC-540.01001), "Ootacamund, India, 3-28-1892. R.N. $\frac{312}{20\text{-}3\text{-}20}$ Collected by Dr. F. H. Gravely to whom I am indebted for the opportunity of studying this most interesting specimen. Association or non-as-

sociation with bees not stated.

Diagnosis. Separable from its nearest known allies by the characters given in the preceding keys. Carapace typically cheliferoid in shape, with transverse furrows extremely deep and with a distinct longitudinal furrow; with large regularly spaced seta-bearing tuberculations; somewhat broader posteriorly than long and bordered posteriorly by about 24 small thick setae. Galea short and small, bearing about half a dozen short, recurved, terminal branches. Chaetotaxy of chelicera as in *sculpturatus.* Serrula exterior with about 22 blunt teeth; serrula interior apparently lacking the usual terminal lobes although the material available does not suffice to render this point certain; lamina exterior typical. Chaetotaxy and distribution of sense spots of chela essentially as in *sculpturatus.* Palps similar to *sculpturatus* in general appearance but differ in the smaller size and greater abundance of the tubercles which give the palps their typical sculptured appearance; trochanter 1.5-1.6 times as long as broad; femur subequal to tibia in length and 2.3 times as long as broad; tibia 2.3-2.5 times as long as broad; fingers clearly shorter than hand; chela 2.8-2.9 times as long as broad. Fixed finger of chela with 33 marginal teeth; movable finger with 38. Both fingers show moderate sub-terminal depressions in the dental profile but no dental specialization. First nine tergites with tergal crests which are distinctly setose; individual tergal scutae almost contiguous or even subimbricate; longitudinal suture very narrow, linear; tergites each with about 16-20 discal setae in addition to the marginal row of 25-35. Tergites and carapace very sclerotic, tergites tesselated and with large clear areas surrounding each seta, thus giving the whole a peculiar nucleated appearance. Tergites gradually increase in length posteriorly but none are strikingly narrower than the others. Coxal area typical, broadest across second to fourth coxae, narrowest across first coxae. Male genital structures peculiar in that the ramshorn organs are here apparently absent in spite of their pronounced and quite normal development in its closest relative *sculpturatus;* coxal sacs also absent. Coxae IV normal in shape, without coxal spurs. Sternites rather heavily sclerotic and regularly and evenly tesselated; sternal setae simple; sternites with 6-8 discal and 22-26 marginal setae. Legs typically cheliferine, all tarsi provided with a distinct terminal spine which serves apparently as a sheath for the retracted claws; foreclaws of male moderately asymmetrical but not toothed. Distinctly differentiated spiracular guard sclerites occur, the anterior pair of which bear 2-3 simple setae each. Anterior tracheal trunks extremely large and ventrally longitudinally impressed, three times as long as the guard sclerite. Length of expanded ♂, 3.8 mm. Greatest abdominal breadth 1.8 mm.

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SOME UNDESCRIBED RACES OF NOTODONTIDAE (LEPID.)*

BY J. McDUNNOUGH,
Ottawa, Ont.

Lophodonta ferruginea var. **reducta** n. var.

Characterized by the reduction of white shading on primaries, notably in the basal and median areas; in the latter section the reniform alone shows up prominently as a white half-moon; there are traces of pale filling in the t. a. and t. p. lines; s. t. line scarcely indicated. Expanse 40-45 mm.

Holotype—♂, Aweme, Man., July 16, (E. Criddle); No. 3372 in the Canadian National Collection, Ottawa.

Paratypes—1 ♂, same locality, July 5, (S. Criddle); 1 ♂, Hymers, Ont., June 28, (H. Dawson).

In the Hymers paratype even the white reniform is lacking and the lines scarcely indicated.

Cerura multiscripta var. **canadensis** n. var.

Thorax and abdomen heavily suffused with black, latter with segments ringed with white posteriorly and with white anal tuft in male. Primaries with a heavy black suffusion; the space between the third and fourth cross-lines is entirely filled with black, forming a broad dark band across the wing; the median area is also more heavily black-shaded than in the normal form, generally leaving some white areas along costa and two pairs of white lunules between veins 2 and 4. Terminal area as usual, dull white, crossed by dark veins and with large black marginal dots. Secondaries in both sexes deep smoky. Expanse, ♂, 26 mm.; ♀, 30-35 mm.

Holotype—♂, Norway Pt., Lake of Bays, Ont., (bred at Ottawa), April 27, 1931, (J. McDunnough), No. 3373 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, May 2.

Paratypes—6 ♀, Ottawa, Ont., (C. H. Young and J. McDunnough), all bred and emerged in March and April.

The larvae correspond fairly well with Packard's figure of *multiscripta* larva but show larger dark lateral blotches in the mid-abdominal segments.

Fentonia marthesia var. **manitobensis** n. var.

Primaries more suffused with smoky than in the normal form and with little of the pale green coloration; in the median area above vein 1 and between veins 3 and 4 and 6 and 8 at their bases are patches of light olive-brown, much as in *dorothea;* vein 1 rather strongly marked with black from base to nearly t. a. line. Expanse 44 mm.

Holotype—♂, Aweme, Man., July 19, (N. Criddle); No. 3374 in the Canadian National Collection, Ottawa.

Paratype—1 ♂, same data.

*Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

THE SUBFAMILY LYCAOTINAE IN NORTH AMERICA (HYMENOPTERA, TENTHREDINIDAE)

BY HERBERT H. ROSS,
Illinois State Natural History Survey, Urbana, Illinois.

The genus *Lycaota* was placed by MacGillivray (1908) in a separate subfamily closely related to the Tenthredininae. Rohwer in 1911, transferred it to the subfamily Blennocampinae (Empriinae of Rohwer) on the basis of the position of the medio-cubital cross-vein. A study of the Selandriinae, Emphytinae and Blennocampinae indicates very strongly that the three subfamilies form a compact unit and that the predicellate condition of the first anal cell in the Blennocampinae arose from the condition existing in the Selandriinae and Emphytinae, not from the condition exhibited by *Lycaota,* which is very typical of the condition found in a large number of the Tenthredininae. It seems more logical, therefore, to accept for the present the interpretation of MacGillivray and consider the Lycaotinae a distinct subfamily most closely related to the Tenthredininae, separated from it by having the first medio-cubital cross-vein joining the radio-medial stem at the point of origin of media, not basad of that point.

KEY TO NEARCTIC GENERA

1. Length of cell R_4 about equal to that of cell R_5, first abscissa of M_2 almost twice as long as second abscissa (Fig. 11); male with a very wide and round head on the penis valves (Fig. 15); female with hind tarsi similar in size and proportion to those of middle tarsi (Figs. 1, 2 and 5); legs of both sexes black .....*Lycaota* Konow.

   Length of cell R_4 distinctly longer than that of cell R_5, first abscissa of M_2 almost subequal in length to the second abscissa (Fig. 10); male with head of penis valves rectangular (Fig. 16); female with hind tarsi short and stout (Figs. 4 and 6), dissimilar in proportion to middle tarsi Fig. 3); legs of both sexes light reddish brown.....*Lycaotella* n. gen.

Genus *Lycaota* Konow

Lycaota Konow, Zeit. fur Hymen. und Dipt., Vol. 3, 1903, p. 147; Genera Insectorum, 29me. Fasc., 1905, p. 101; Rohwer, Bull. U. S. Dept. Agr., Bur. Ent., Tech. Ser., No. 20, Pt. II, March 4, 1911, p. 82; Proc. U. S. Nat. Mus., Vol. 41, No. 1866, October 14, 1911, p. 384; Proc. Ent. Soc. Wash., Vol. XIII, 1911, p. 223.

Generic characteristics.—Front wings (Fig. 11) with cell R_4 subequal in length to cell R_5. Female with hind tarsi slightly shorter than middle tarsi but of the same proportions, tibial spurs of hind tarsi short, only about one-third the length of the basitarsus, tarsal claws small with a minute tooth near middle (Figs. 1, 2 and 5); lancet of saw with wide segments (Fig. 9a), lance with ventral margin possessing round, lobe-like teeth (Fig 9b). Male with head of penis valves more or less rounded (Fig. 15), the head much shorter than the stem.

Genotype.—Selandria sodalis Cresson (original designation, also monobasic).

This genus contains only one species.

Lycaota sodalis (Cresson)

Selandria sodalis Cresson, Trans. Amer. Ent. Soc., Vol. VIII, 1880, p. 44, ♀; Weldon, Can. Ent., Vol. XXXIX, No. 9, September, 1907, p. 302; Cresson, Mem. Amer. Ent. Soc., No. 1, 1916, p. 9.

Lycaota sodalis Konow, Zeit. fur Hymen. und Dipt., Vol. 3, 1903, p. 147, Genera Insectorum, 29me. Fasc., 1905, p. 102; Rohwer, Proc. U. S. Nat. Mus., Vol. 41, No. 1866, October 14, 1911, p. 384.

Lycaota fusca Rohwer, Can. Ent., Vol. XL, No. 6, June 1908, p. 180, ♂.

Type.— ♀, Colorado; No. 361 in the collection of the American Entomological Society, Philadelphia, Pennsylvania.

This species exhibits considerable color antigeny. The female is jet black in color with the pronotum, mesonotum and mesopleura bright rufous, the tibiae grayish or darker, and the wings uniformly dark brown infuscate. The male differs only in lacking the rufous coloring, the body being entirely black. The female has the sheath as in Fig. 12, long, thin and without a lateral lip at apex; saw as in Fig. 9a and b. Male genitalia as in Figs. 15, 17 and 17a.

Distribution.—1 ♂, 1 ♀, Saskatoon, Sask., May 14, 1924 (K. M. King); 1 ♂, 1 ♀, "Colo."; 1 ♀, Salmon Arm. B.C., April 28, 1930 (H. B. Leech).

Lycaotella n. gen.

Generic characteristics.—Possessing the characteristics of the subfamily Lycaotinae, and in addition the following. Front wings as in Fig. 10, cell R_4 much longer than cell R_5 and subequal to cell R_3, first abscissa of M_2 subequal to second. Female with hind tarsi (Fig. 6) curiously modified, shorter than middle tarsi (Figs. 3, 4), the second, third and fourth segments very short and stout, broader than long, the tibial spurs large and two-thirds the length of the basitarsus, the tarsal claws very large and pincer-shaped, with a large basal tooth. The front and middle tarsi (of the female) similar in proportions to the hind tarsi of *Lycaota* (Fig. 5), being more slender and having small, almost simple, tarsal claws, but having longer tibial spurs. The hind tibiae of the female are thicker and more gradually widening than those of *Lycaota*. The legs of the males of the two genera are practically inseparable. Saw having the lancet as in Fig. 7, with narrow segments, and the lance as in Figs. 8 and 8a, the ventral margin finely serrate, but not with the prominent round teeth of *Lycaota*. Male genitalia with the head of the penis valves more or less rectangular (Fig. 16), the head subequal in length to the stem.

Genotype.—Selandria (Hoplocampa) spissipes Cresson (original designation).

This genus can be separated from *Lycaota* Konow, its only close relative, by the characters given in the key. It includes only two species, *spissipes* (Cresson) and *coloradensis* Rohwer. In both of these the sheath has a small, lateral lip at the apex. The saws are similar.

KEY TO THE NEARCTIC SPECIES

1. Males (apical sternite flat and entire) 2
-. Females (apex of abdomen with a sheath) 3
2. Venter and dorsum of abdomen mostly rufous, with median and lateral black lines ..... *spissipes* (Cresson)
..... and *spissipes* var. *brunneus* (Rohwer)
-. Venter of abdomen black, dorsum black with a basal rufous area.....
..... *spissipes* var. *typicella* (MacGillivray)
3. Sheath narrow at apex (Fig. 13), the lower margin in a gradual concave curve; clypeus entirely black; area along division of mesopleura and pectus rufous, concolorous with pleura ..... *coloradensis* (Rohwer)

-. Sheath wide at apex (Fig. 14), the lower margin straight or slightly produced into an arcuate hump; clypeus with anterior margin yellowish rufous; area along division of mesopleura and pectus black, pleura rufous.....4

4. Pectus entirely or mostly black, mesopleura rufous.....*spissipes* (Cresson)
Pectus rufous and mesopleura rufous, separated by a black band.....5

5. Antennae and orbits entirely black; abdomen mostly black with some rufous at base and apex .....*spissipes* var. *typicella* (MacGillivray)

-. Orbits and two basal segments of antennae mostly rufous; abdomen mostly rufous .....*spissipes* var. *brunnea* (Rohwer)

Lycaotella coloradensis (Rohwer)

Lycaota coloradensis Rohwer, Proc. U. S. Nat. Mus., Vol. 41, No. 1866, October 14, 1911, p. 384, ♀.

Type.—♀, Colorado (C. F. Baker Collection); Cat. No. 13839, in the U. S. National Museum.

The female of this species differs from that of *spissipes,* to which it is closely related, in the shape of the sheath (Fig. 13). It is hard to find other structural differences which are constant through a long series of *spissipes.* Although only two specimens of *coloradensis* (both from the typic series but not paratypes) have been examined, certain color differences have been noted which are constant in all specimens of *spissipes* studied and these differences are given in couplet 5 of the key. The male of *coloradensis* is yet unknown, and may be masquerading in collections as *spissipes,* due to the lack of obvious structural differences and the non-application to the males of the color differences found in the females, due to antigeny.

Distribution.—"Colo."

Lycaotella spissipes (Cresson) (*sens. st.*)

Selandria (*Hoplocampa*) *spissipes* Cresson, Trans. Amer. Ent. Soc., Vol. VIII, 1880, p. 14, ♀; Mem. Amer. Ent. Soc., No. 1, 1916, p. 9.

Selandria (*Hoplocampa*) *lenis* Cresson, Trans. Amer. Ent. Soc., Vol. VIII, 1880, p. 14, ♂; Mem. Amer. Ent. Soc., No. 1, 1916, p. 5.

Macrophya spissipes Konow, Genera Insectorum, 29 me. Fasc., 1905, p. 123.

Zaschizonyx lenis Konow, *ibid.*, p. 131.

Hoplocampa lenis Weldon, Can. Ent., Vol. XXXIX, No. 9, September, 1907, p. 302.

Hoplocampa spissipes Weldon, *ibid.*

Lycaota spissipes Rohwer, Bull. U. S. Dept. Agr., Bur. Ent., Tech. Ser., No. 20, Pt. IV, May 27, 1911, p. 147; Proc. U. S. Nat. Mus, Vol. 41, No. 1866, October 14, 1911, p. 384.

Type.—♀, Colorado; No. 362 in the collection of the American Entomological Society.

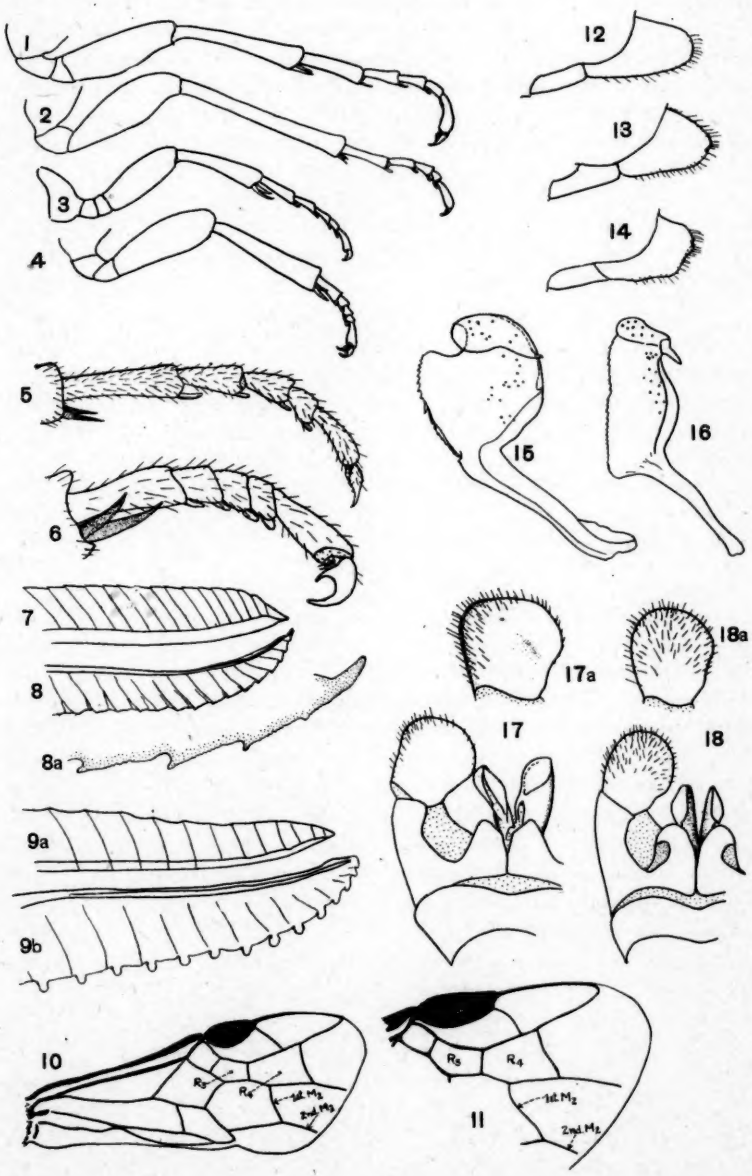
The typical form of this species has the orbits, antennae and pectus black, the pectus sometimes slightly fuscous on the meson, and black areas on the mesoscutum. The male differs in having both the pectus and mesopleura black, the latter sometimes with an indistinct rufous area, and also in having the clypeus wholly black. In the series of female specimens of this species collected by Dr. Bird in Manitoba all intergrades are found between this and the following varietal form.

The genitalia of this species are as in Figs. 7, 8, 8a, 16, 18 and 18a.

Some years ago at Agassiz, B. C., the author reared the variety *typicella* from terminal bud galls of *Symphoricarpos racemosa.* For rearing data see under *typicella.*

The varietal forms of *L. spissipes* are very analogous in color and distribution to the various color phases of another sawfly, *Zaschisonyx montana*

CAN. ENT. VOL. LXIV PLATE 1.



THE SUBFAMILY LYCAOTINAE

(Cresson), which breeds upon the same genus of plants. Z. *montana* has approximately the same geographic distribution as *L. spissipes,* and similarly exhibits three varietal forms, the two lighter ones occurring, intermingled, west of the Rocky Mountains in the more northern regions of the Great Plains, and the darker, melanic form occurring west of the Rocky Mountain divide in British Columbia and slightly southward. It is interesting to find such a close parallel of variation between species in different genera.

Distribution.—10 ♂ ♂, 2 ♀ ♀, Birtle, Manitoba, May 15 to June 8, 1928 (R. D. Bird); 4 ♂ ♂, Aweme, Manitoba, May 15 to June 4, 1926 (R. D. Bird); 3 ♂ ♂, Saskatoon, Saskatchewan, May 14, 1924 (K. M. King); 1 ♀, Gull Lake, Alberta, June 14, 1929 (E. H. Strickland).

Lycaotella spissipes var. *brunnea* Rohwer

Lycaota spissipes brunneus Rohwer, Proc. U. S. Nat. Mus., Vol. 41, No. 1866, October 14, 1911, p. 384, ♀.

Type.—♀, Montana; Cat. No. 13838 in the U. S. National Museum.

This varietal form differs from the typical one in having the orbits, basal two segments of the antennae, mesoscutum and pectus rufous, and the pectus and mesopleura separated by a black band. In the series examined from Manitoba specimens approaching this variety predominated. No conspicuous color segregation was noticed in the male specimens, but it may be that those in which the mesopleura had a rufous area should be placed in this variety.

Distribution.—2 ♀ ♀, Montana (typical series); 7 ♀ ♀, Birtle, Manitoba, May 30 to June 8, 1928 (R. D. Bird).

Lycaotella spissipes var. *typicella* (MacGillivray)

Blennocampa typicella MacGillivray, Univ. Ill. Bull., Vol. 20, No. 50, August 13, 1923, p. 8, ♂; Frison, Bull. Ill. Nat. Hist. Surv., Vol. XVI, Art. IV, February, 1927, p. 238.

Type.—♂, Corvallis, Oregon, March 14, 1915 (L. Childs); in the MacGillivray Collection, University of Illinois.

The male of this variety differs from the other forms of the species in that the body, excluding the appendages, is black except for a rufous spot on the mesal portion of the dorsum of the abdomen on the more basal segments. The female has not hitherto been described.

Female.—Similar in structure and general color to the typical form of *spissipes.* Diagnostic color characters as follows: head with anterior margin of clypeus luteous, orbits and antennae black; mesopleura and pectus rufous, separated by a black band; abdomen mostly black with some rufous at base and apex. Otherwise as in the typical form.

Allotype.—♀, Agassiz, British Columbia, reared from gall on *Symphoricarpos racemosa,* 1927-1928 (H. H. Ross). Deposited in the Canadian National Museum.

It differs from *spissipes* in the rufous pectus and blacker abdomen and from *spissipes brunneus* in the black orbits, antennae and abdomen. This color phase occurs west of the Rocky Mountain divide and is the only race of the species yet taken in that region.

Larvae of this form were collected on *Symphoricarpos racemosa.* They had formed a gall of the terminal leaves of young shoots, the leaves being contorted and wrinkled, paler green than the surrounding foliage, and bunched together into a tight globe. The larvae when mature had a green body and

chocolate colored head. They were collected on May 30, 1927, and entered the soil to aestivate and hibernate about June 10, emerging as adults about March 15, 1928. Unfortunately so few larvae were found that all were reared and none saved for study.

Distribution.—3 ♂ ♂, 4 ♀ ♀, Agassiz, Britiish Columbia, reared as above; 1 ♀, Vernon, British Columbia, May 5, 1907.

EXPLANATION OF PLATE I.

Fig. 1. Middle leg of female *L. sodalis.* Fig. 2. Hind leg of female *L. sodalis.* Fig. 3. Middle leg of female *L. spissipes.* Fig. 4. Hind leg of female *L. spissipes.* Fig. 5. Hind tarsi of female *L. sodalis* showing one tarsal claw. Fig. 6. Hind tarsi of female *L. spissipes* showing one tarsal claw. Fig. 7. Lancet of *L. coloradensis.* Fig. 8. Lance of *L. spissipes;* 8a, enlarged portion of ventral edge of same. Fig. 9. a, lancet, b, lance, of *L. sodalis.* Fig. 10. Front wing of *L. spissipes.* Fig. 11. Portion of front wing of *L. sodalis.* Fig. 12. Lateral view of sheath of *L. sodalis.* Fig. 13. Lateral view of sheath of *L. coloradensis.* Fig. 14. Lateral view of sheath of *L. spissipes.* Fig. 15. Lateral view of penis valve of *L. sodalis.* Fig. 16. Lateral view of penis valve of *L. spissipes.* Fig. 17. Portion of ventral aspect of male genitalia of *L. sodalis;* 17a, full lateral view of clasper. Fig. 18. Portion of ventral aspect of male genitalia of *L. spissipes;* 18a, full lateral view of clasper.

SOME ERYTHRONEURA (GRAPE LEAF HOPPERS) OF THE MACULATA GROUP. (HOMOPTERA CICADELLIDAE)

BY R. H. BEAMER,
Department of Entomology, University of Kansas, Lawrence, Kansas.

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44. **Erythroneura mira** n. sp.

General ground color semihyaline to yellowish-white marked with red or orange. Vertex with semblance of five white spots more or less surrounded with bands of color. Pronotum with a median triangular or sometimes rectangular spot not touching either margin and the usual angular spot back of each eye. Scutellum with tip red and basal angles yellow bordered with red or orange on outer margins. Clavi with usual basal anchor-shaped mark and spot before tip. Coria with angulate spot arising on costa before humeral angle, another irregular-sided angulate vitta arising on costa at anterior end of plaque, more or less surrounding it, and ending on mesal margin near tip of clavus in an enlarged area. Cross-veins red. Small black spot in base of cell M_4 and smaller one in posterior end of plaque. Tips of tegmen more or less dusky. Venter stramineous with a red V-shaped cross-band on face.

Genitalia. Pygofer hook single, extends to tip of pygofer, forked on outer third, inner branch leaves other at right angles, both branches of about equal size. Style with small foot; base curved; heel moderate; anterior point short about a right angle; posterior point longer, less than right angle. Oedagus of medium size, almost straight in any view, in lateral view rather wide, almost cylindrical with rounded tip.

Holotypes; male, Wabash Co., Ill., March 31, 1929, R. H. Beamer.

Paratypes; as follows; 4, Washington, D. C., 49, Maryland; 1, Virginia, 2, Arkansas; 2, Iowa; 2, Ill.; 1, North Carolina.

45. **Erythroneura restricta** n. sp.

General ground color semihyaline to yellowish white marked with orange. Vertex with semblance of five yellowish-white spots more or less surrounded with orange bands, median spot oval. Pronotum with median triangular-shaped spot not touching either margin but with more or less projections from anterior corners, usual angular spot back of each eye. Scutellum with tip orange,

basal angles yellow with small orange spot in basal corner. Clavi with usual basal anchor-shaped mark, usually broken or nearly so in middle, and a more or less round mark just before tip. Coria with small angular dash near base, another irregular-sided, angular vitta, arising at anterior end of plaque and ending near apex of claval suture, another angular dash arising at posterior end of plaque and ending in an enlarged area at cross-veins on mesal margin. Cross-veins red. Large black spot in base of cell M_4 and very small one in posterior end of plaque. Tips of tegmen more or less dusky.

Genitalia. Pygofer hook double, not extending to tip of pygofer, each portion of hook diverging then converging to almost touch at tip, inner branch slightly narrower than outer. Style with large foot; base curved; heel large; practically no points although sometimes anterior one extends farther than posterior. Oedagus of medium length, straight from any view, tip rounded, sides almost parallel; lateral view of base, at least in some specimens, forming a sharp point.

Holotype; male, Ames, Iowa, April, 18, 1930, R. H. Beamer.

Paratypes as follows: 1 male, Polk Co., Ark., 1928; 1, Dead Run Swamp., W. L. McAtee; 1, Plummer's Id., Md., W. L. McAtee; 6, Clayton Co., Iowa, R. H. Beamer; 6, Marshall, Ark.; 3, Glen Echo, Md.

46. **Erythroneura aesculi** n. sp.

General ground color semihyaline to pearly white, marked with bright red. Vertex with semblance of three white spots surrounded with yellow or red bands. Pronotum with median yellow or red heart-shaped spot not touching either margin, usual angular mark back of each eye. Scutellum with basal angles yellow. Clavi with basal two-thirds, except extreme base, and semicircular spot on mesal margin just before end of spot, bright red. Coria with bright red rectangular spot opposite posterior half of claval spot.

Genitalia. Pygofer hook, single, of medium length, gradually growing wider to bifid tip, notch between points angular not rounded. Style with medium foot; base almost straight; heel large; anterior point short, less than right angle; posterior point longer than foot, almost parallel sided, with tip slightly curved out. Oedagus short, slightly widened toward tip, surrounded with short sharp spines.

Holotype; male, Columbus, Miss., VII-16-30, R. H. Beamer.

Allotype; female, and numerous paratypes of both sexes same data.

This species was taken on *Aesculus* sp. It is quite close to *E. pyra* McA. from which it may be separated by the much smaller white spot on disc of tegmina and by the notch between the forks of the pygofer hook being angular instead of rounded.

47. **Erythroneura adunca** n. sp.

General ground color semihyaline to pearly white usually marked with very thin red lines and spots. Vertex with semblance of three white spots surrounded with thin red lines in some specimens, others with very slight red markings. Pronotum with median red triangular mark not touching either margin, sometimes with slight projection from anterior corners, usual triangular mark back of each eye. Scutellum with red spot on tip, yellow basal angles with red dash on outer margin. Clavi with thin basal anchor-shaped mark often broken in middle and more or less rectangular spot just before tip. Coria with spot

on costa just before humeral angle, an angular dash arising on costa at anterior end of costal plaque and ending just before claval suture, another angular vitta arising at posterior end of plaque and ending just before tip of clavus. Cross-veins more or less red. Small black spot in base of cell M_4, and still smaller one in posterior end of plaque. Tips of tegmina slightly dusky. Venter stramineous tinged with pink.

Genitalia. Pygofer hook single, tapering from base to tip, slightly incurved. Style with large foot; base straight; heel large; toe quite narrow; almost no anterior point, slightly less than right angle; posterior point as long as or longer than foot, almost straight, forming slightly less than a right angle with foot. Oedagus quite small, in lateral view U-shaped, twice as large at base as at tip, slightly curved dorsally.

Holotype; male, Rock Creek Park, Washington, D. C., Dec. 31, 1928, R. H. Beamer.

Allotype; female, same data.

Paratypes; 22 males, Washington, D.C.; 2 males, Cherokee Co., Kans.; 28 males, Glen Echo, Md.; 1, Walnut, N. C.

This species is close to *E. gemina* McA. but may be separated from it by its thinner markings and by the oedagus in lateral view being much smaller and the inner margin being curved in *adunca* while it is straight in *gemina.*

48. **Erythroneura linea** n. sp.

General ground color semihyaline to yellowish, marked with red or orange. Vertex with semblance of five yellowish white spots more or less surrounded with red bands. Pronotum with median Y or U-shaped spot, not connected with posterior margin but more or less connected with anterior; area between arms of Y often lighter in color and somewhat rectangular; angular spot back of each eye large, often reaching more than half way to posterior margin. Scutellum with tip red, basal angles yellow, margined on two sides with red. Clavi with usual basal anchor-shaped spot and large more or less rectangular spot before tip. Coria with large angular vitta on costa just before humeral angle, another arising at anterior end of costal plaque and ending at claval suture, small spot at posterior end of plaque, dash of red on M_1, and triangular spot with its base on Cu and apex at tip of clavus. Cross-veins more or less red. Black spot in base of cell M_4 and in posterior end of plaque. Venter stramineous more or less tinged with pink, V-shaped red cross-band on face. One row of black spines on hind tibia.

Genitalia. Pygofer hook single, short, wider in middle than at base, about one-fifth distance from tip it narrows abruptly to spine-like tip. Style with large foot; base almost straight; heel large; toe very narrow; practically no anterior point; posterior point as long or longer than foot, very narrow, almost thread-like, it is narrowest posterior point yet seen, slightly curved in, general trend is about at right angles to foot. Oedagus of medium length, very broad, heart-shaped in dorsal view, almost straight in lateral view, slightly tapering from base to tip, covered over most of surface with sharp closely set spines.

Holotype; male, Cherokee Co., Kans., Nov. 29, 1928, R. H. Beamer.

Allotype; female, same data.

Paratypes; 8 males and one female from same locality.

This species is separated from all others by the very narrow posterior

point of the style and shape of the pygofer hook.

49. **Erythroneura opulenta** n. sp.

General ground color yellowish white, markings very bright red even in summer specimens. Vertex with a longitudinal, rather broad vitta, sometimes narrowed at middle. Pronotum with median longitudinal, narrow, heart-shaped spot, usually not reaching posterior margin but more or less connected with the angular spot back of each eye by a curved line. Scutellum with tip red and a very small spot in each basal angle. Clavi with rather narrow somewhat anchor-like, basal mark and spot before tip. Coria with small angular dash on costa before humeral angle, smaller spot at anterior end of costal plaque, more or less round spot opposite middle of plaque between M_1 & Cu, and triangular spot between same two veins about half distance to base of cell M_4. Cross-veins more or less red. Large black spot in base of cell M_4, smaller one in posterior end of plaque. Tips of tegmina more or less dusky. Venter stramineous. One row of black spines on hind tibia.

Genitalia. Pygofer hook single, with S-curve, angles of which tend to be almost rectangular, not excessively long. Style with medium foot; base curved; heel medium; almost no points, anterior one short, sharp extending out, posterior one just about a right angle. Oedagus straight in lateral view, medium length, somewhat swollen medianly.

Holotype; male; *Allotype;* female, and three paratypes from Lacoochee, Fla., August 18, 1930, R. H. Beamer. 1 female, Ocala Fla., Nov. 6, 1927. All specimens were swept from Oak.

The brilliant color of the spots of these summer specimens along with the genital characters serves to clearly define this species.

50. **Erythroneura retusa** n. sp.

General ground color semihyaline to yellowish white marked with red or orange. Vertex rather sharply pointed with median longitudinal broad stripe, semblance of spot at anterior corner of each eye. Pronotum with median Y-shaped spot touching each margin, usual angular spot back of each eye reaching half way to posterior margin. Scutellum with tip orange, basal angles yellow. Clavi with usual anchor-shaped basal mark and rectangular spot before tip. Coria with spot on costa midway between plaque and humeral angle, zigzag, irregular-sided vitta surrounding costal plaque and ending before base of cell M_4. Cross-veins red or orange. Tips of tegmina more or less dusky. Black spot in base of cell M_4 and in posterior end of costal plaque. Venter stramineous tinged with yellow. Row of spines on front tibia black or dark brown.

Genitalia. Pygofer hook single, evenly S-curved, slightly wider in middle. Style with long foot; base straight; almost no heel; anterior point short, less than right angle, projecting out and anteriorly; posterior practically wanting greater than right angle. Oedagus very short and stout, tapering slightly from base, ending in a flattened lip-like tip which extends both dorsally and laterally.

Holotype; male, Lacoochee, Fla., 8-18-30, R. H. Beamer.

Allotype; female, nine male and thirteen female paratypes same data.

This species was swept from oak near the banks of the Withlacoochee river. It may easily be separated from any other species by the type of pygofer hook and the peculiar flattened tip of the oedagus.

(to be continued)

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